Fragmentable grenade

The present invention relates to an improvement made to grenades used, for example jointly with tear gases, for dispersing crowds.

The international patent application WO 97/18435 divulges a grenade of such type, fragmentable into several projectiles of kinetic energy which is small enough so as to not to cause any serious injuries to the people exposed thereto. This grenade contains an inner sheath and non-metal projectiles interconnected individually to said sheath and surrounded by a thermoretractable envelope. Such a grenade requires unit manufacture of the projectiles, then the assembly thereof onto the inner sheath, which bears upon the production costs. Moreover, the outer envelope may compromise the dispersion of the projectiles.

There is a need to have a fragmentable grenade which is easier and less costly to manufacture.

The invention meets this requirement by offering a new fragmentable grenade, comprising:

- an explosive charge,
- a layer of elastically deformable projectiles connected together by bridges of material produced by moulding together with the projectiles, said layer surrounding the charge and being designed for enabling the projectiles to separate and to disperse when the said charge explodes.

The presence of the layer of projectiles enables simplification of the production of the grenade, since the projectiles need not be manufactured nor assembled individually any longer. The layer may also enable optimisation of the volume of the grenade, i.e. for the same outer space requirements, mass increase of the projectiles, or taking an equal mass, gauge reduction of the grenade.

In a particular embodiment, the layer comprises two rims assembled, preferably glued together. The grenade may then include half-projectiles assembled along an assembly line. The projectiles thus reconstructed may exhibit ballistic characteristics which are very close to those of other projectiles of the layer, which are monolithic.

The bridges of material may be situated on the outside of the layer. This point proves advantageous to confer the grenade relatively smooth external surface without resorting to an added thermoretractable envelope, which is useful in particular in case when the grenade is ejected by a

grenade-thrower. As a variation, the bridges of material may be situated on the inside of the layer or somewhere else.

The thickness of the bridges of material may be selected relative to the mechanical characteristics of the material used in order to mould the layer and may also account for less than 10%, better less than 5% of the maximum thickness of the projectiles.

The projectile layer may be deprived of openings, or as a variation include openings, in particular openings extending between the bridges of material.

The projectiles are advantageously deprived of sharp edges, so as to limit the risks of serious lesions at impact.

According to an embodiment, the projectiles exhibit radially internal and external faces, each at least partially and substantially in the form of a cylindrical portion and, between themselves, substantially planar and radial faces.

The layer delineates an inner housing wherein the explosive charge is placed. The grenade may include a detonator and an ignition retardation device. The inner housing may accommodate the detonator and the possible ignition retardation device, which is sold commercially as an "ignition retardation plug" and may have a screw or clip type interface enabling either manual throwing of the grenade if it is fitted with a lever equipped with a safety pin, or throwing using a fire arm, generally a rifle, if it is equipped with a self-propelling plug or a percussion fuse.

The inner housing may exhibit widened portions at its axial ends and one of them may receive the detonator at least partially.

The elastically deformable material whereof the projectiles are composed, may have a hardness ranging for example between 20 and 55 Shore A, in particular between 35 and 45 Shore A, let alone approx. 40 Shore A, and consist of EPDM for instance, or any other suitable elastomer, natural or synthetic.

The material used may also be completed with chemicals intended for improving the physical or chemical qualities thereof, during the manufacture or after.

The elastically deformable material may for instance include a charge of a compound enabling reduction of the friction coefficient of the grenade, for example graphite or PTFE.

The elastically deformable material may also comprise, if necessary, metal particles or not, particles made of a composite material or a plastic material. The added particles may enable for example to increase or to reduce the density of the projectiles. They may enable for example to reduce the elasticity of the elastically deformable material, which may enable for example easier fracture of the bridges of material when the charge explodes.

For example, an elastically deformable material comprising particles having dynamic characteristics comparable to those of biological tissues may be used, with possibly materials which are similar to those employed usually for cosmetic surgery prostheses or exhibiting neighbouring characteristics.

At least one projectile may contain an agent, for example a powder, a liquid or a gas, intended for producing a physiological effect, for instance CS or capsicum. This agent may for example be contained, in particular in encapsulated state, in a cavity defined by at least one projectile.

The grenade may be designed for being thrown manually and exhibit a size suited to that effect. As a variation, the grenade may be designed for being thrown with a grenade-thrower. In such a case, firing can be brought about by an impact onto the target or the ground. As a variation, firing may be linked with a triggering pyrotechnical chain of the shot of the grenade-thrower.

The grenade may include, moreover, a guiding shoe or an over-calibration shoe intended for improving the friction coefficient and the rear tightness. Such a shoe may also enable to throw grenades of an undersized gauge with an existing grenade-thrower, intended for throwing grenades of a greater gauge.

The invention also relates, independently or in combination with the foregoing, to a method for manufacturing a layer of projectiles including the following step:

- moulding with an elastically deformable material, in particular a natural or synthetic elastomer, a layer of projectiles linked together with bridges of material uniting them.

One may notably:

- mould in a single pass a plurality of layers or projectiles together linked together by bridges of materials uniting them into an elastically deformable material, in particular a natural or synthetic elastomer, for

example four layers at a time. The layers of projectiles may each be monolithic.

Each layer may be flat moulded, being for example generally rectangular in shape, then rolled and butt-glued, both edges before gluing each including a row of half-projectiles. Each individual layer may thus be used for later manufacture of a grenade.

A layer of projectiles used for manufacturing a grenade may also be moulded into a single block with an annular shape in an elastically deformable material, then taken out of the mould thanks to the elasticity thereof, for example by applying externally a pressure smaller than the pressure existing on the inner side of the layer of projectiles, or by applying internally an overpressure.

If necessary, regardless of the moulding method employed, the layer may be immersed into a bath of a compound enabling to reduce the friction coefficient of the grenade, for example PTFE or similar.

The invention still relates to a method of assembly of a fragmentable grenade, including:

- the supply of a layer of projectiles connected together by bridges of material obtained by moulding with the projectiles,
- the placement of an explosive charge in an inner housing delineated by the layer.

The invention may also be understood better when reading the detailed description below, of an example of an embodiment not limited thereto, and in conjunction with the appended drawings whereon:

- Figure 1 is a perspective view, schematic and partial, of a fragmentable grenade according to the invention,
- Figure 2 represents individually and in perspective a layer of projectiles used for the manufacture of the grenade of Figure 1,
- Figure 3 is a cross-section, partial and schematic, of the layer of projectiles of Figure 1, and
- Figure 4 represents individually the layer of projectiles of Figure 1 as a longitudinal section.

Figure 1 represents a fragmentable grenade 1 including a layer 4 of projectiles 5 connected together by bridges of material 6, produced by moulding with the projectiles 5. The layer 4 surrounds an explosive charge 2, contained in a tube 3 and known by itself.

The layer 4 is intended for enabling the projectiles 5 to separate and to disperse when the charge 2 explodes.

For added clarity, Figure 2 represents individually the layer 4 of projectiles, on the inner side and after a deformation pushing the projectiles 5 aside.

In the example considered, the layer 4 exhibits, when laid flat to suit the needs of observation, general rectangular shape and includes for instance three rows of projectiles 5, each of them comprising five complete projectiles 5 and half-projectiles 5a, 5b. The latter are assembled to one another by gluing along an assembly line A to form the housing receiving the tube 3 containing the charge 2, as can be seen on Figure 1.

The grenade 1 thus includes three stages of projectiles 5 each comprising six projectiles spaced circumferentially, as can be seen on Figure 4, i.e. eighteen projectiles in total. Obviously, one does not depart from the framework of the present invention when the grenade includes a different number of projectiles, for example between twelve and twenty-four projectiles.

The bridges of material 6 are situated on the outer side of the grenade 1. Their thickness *e* represents in the example considered less than 5 % of the maximum thickness E of the projectiles, in such a case approx. 4 % of the maximum thickness E, as can be seen on Figure 3.

It can be seen on Figures 2 and 3 that the projectiles 5 include, in the corners, rounded surfaces 7 enabling to prevent serious injuries for the people hit.

Each projectile 5 exhibits as a cross section, as illustrated on Figure 3, radially external 11 and external 12 sides which are substantially concentric, united by the sides 13 and 14 substantially radial and converging towards the centre of the grenade 1.

In the example considered, once the layer 4 has been assembled, the grenade 1 is generally symmetrical with respect to plans containing its longitudinal axis X.

The layer 4 delineates an inner housing 15 wherein the explosive charge 2 is placed.

This inner housing 15 exhibits a first portion 15a, substantially cylindrical, of a first radius R_1, and under this first portion a second widened portion 15b with two substantially cylindrical stages of respective radii R'_2 and

R_2 with $R_1<R'_2<R_2$, which enables to house for example the detonator and possibly an ignition retardation device.

The housing 15 also includes additionally a third widened portion 15c, substantially cylindrical, of radius $R_3>R_1$, intended for receiving, as an example, a fastening crown of the explosive charge 2 in the centre of the layer 4 of projectiles 5.

The tube 3 fits tightly in the housing 15, and the layer 4 while deforming elastically may contribute to holding the tube 3 in the grenade 1.

The layer 4 is made of an elastically deformable material, which has in the example described a hardness ranging between 20 and 55 Shore A, in particular between 35 and 45 Shore A, let alone approx. 40 Shore A. The material used is, for example, EPDM.

The elastically deformable material may include a charge of a compound enabling to reduce the friction coefficient of the exterior of the grenade, for example graphite or PTFE. The elastically deformable material may comprise metal particles, particles made of composite material or of plastic material.

At least one of the projectiles may contain an agent such as a powder, a gas or a liquid, intended for producing a physiological effect, in particular CS or capsicum.

In the foregoing, the bridges of material 6 connect the projectiles 5 without forming any openings, but this is not departing from the framework of the present invention, when for instance the bridges of material 6 delineate openings which may facilitate the separation of the projectiles 5 from one another when the charge explodes.

Throughout the description, inclusive of the claims, the expression 'including one' should be understood as synonymous of 'including at least one', unless otherwise specified.